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ABSTRACT

A case study of a 10-year-old boy with cerebral palsy and severe mental retardation investigated whether he would be able to: (1) benefit from a program of supports which includes neuromuscular electrical stimulation (NMES) with intensity sufficient to achieve a tetanic muscle contraction, (2) participate in a weekly program, using NMES, in a task-oriented model of motor learning, and (3) use NMES to achieve the functional outcome of ambulation with foot flat and knees fully extended while wearing floor reaction orthoses and using an assistive device. Reusable self-adhering electrodes were applied to the quadriceps muscles of both legs. The subject then participated in task-oriented motor activities. The treatment was continued for 45 minutes, 20-30 minutes of which included NMES. Results found the intensity of NMES necessary to produce tetanic muscle contraction was achieved after five treatments. The subject was able to participate in a weekly program using NMES in a task-oriented model of motor learning, however, he was not able to achieve foot flat with full knee extension in standing or gait. Treatment was terminated when an orthopedic consult resulted in a team decision to perform bilateral soft tissue releases on the subject's hamstrings. (CR)

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THE USE OF NEUROMUSCULAR ELECTRICAL STIMULATION AS PART OF A PROGRAM OF SUPPORTS TO IMPROVE GAIT IN A CHILD WITH CEREBRAL PALSY AND SEVERE MENTAL RETARDATION – A CASE STUDY

BY

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The Use of Neuromuscular Electrical Stimulation As Part of a Program of Supports to Improve Gait in A Child With Cerebral Palsy and Severe Mental Retardation - A Case Study

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Children with cerebral palsy (CP) often display gait deviations, which impair their mobility and which cannot always be successfully addressed by traditional therapies. Neuromuscular electrical stimulation (NMES) is currently being introduced as a modality for physical therapists to reduce gait deviations in children with CP. In the few reports of the use of NMES in children, success was reported in children who were able to participate reliably in directed play activities. No reports were found of the use of NMES in children with severe mental retardation (MR) who might respond atypically to a new sensory stimulus.

Case

J. is a 10-year-old child with a diagnosis of CP and severe MR. He is atypically reactive to sensory stimuli and displays generalized spasticity. Range of motion is within functional limits. Floor reaction ankle-foot orthoses were prescribed to maintain neutral alignment at the knees and ankles in weight bearing. In the orthoses he was unable to assume foot flat, continuing to take weight on his toes with hip and knee flexion. Exercises to improve his standing posture were not fully successful. J. had begun ambulating short distances in his AFO's using a posterior Wenzelite walker, at school. At home his primary means of mobility was quadruped creeping and knee walking.

Objectives

(1) To determine if a latency age child with CP, severe MR and atypical responses to stimuli is able to benefit from a program of supports which includes NMES with intensity sufficient to achieve a tetanic muscle contraction.

(2) To determine if a latency age child with severe MR and CP is able to participate in a weekly program using NMES in a task oriented model of motor learning.

(3) To determine if such a program is effective to achieve the functional outcome of ambulation with foot flat and knees fully extended while wearing floor reaction orthoses and using an assisitive device.

Method

A small, portable Respond II unit was used. Reusable self-adhering electrodes were applied to the quadriceps muscles of both legs. J. then participated in task oriented motor activities. The treatment was continued for 45 minutes, 20-30 minutes of which included NMES.

Results

(1) The intensity of NMES necessary to produce tetanic muscle contraction was achieved after five treatments. J. indicated awareness of the stimulation by glancing at his legs as the unit cycled on. He would also occasionally initiate bouncing or sit to stand from a bench as the stimulation was introduced. He became briefly upset only when electrodes were placed and removed.

(2) J. was able to participate in a weekly program using NMES in a task oriented model of motor learning. His mother reports increased endurance for ambulation in school using a posterior rolling walker. At home she reports he now is able to pull to stand. In treatment he displays increased endurance and more willingness to stand for play.

(3) J. was not able to achieve foot flat with full knee extension in standing or gait. The use of his orthoses did not appear to influence knee position. Treatment was terminated when an orthopedic consult resulted in a team decision to perform bilateral soft tissue releases on J.'s hamstrings.

Discussion

J. was difficult to consistently engage in tasks involving activation of hip and knee extension in weight bearing, which were the necessary motor skills required to achieve the goal of standing with foot flat and knees fully extended. In repeated treatments his motivation varied with similar play activities and environmental constraints.

Variables which may have affected the outcome:

Attendance: secondary to illness, conflicting appointments and family obligations J. was not able to attend consistent weekly appointments.

Compliance: decreased use of night splinting consisting of bilateral knee immobilizers in conjunction with bilateral ankle-foot orthoses

Variability with
- motivation to engage in goal directed activities.
- emotional responses to play.
- ability to relate to therapist.
-reactions, possibly atypical, to sensory stimuli.

In conclusion, it is suggested that J.'s cognitive function was less important to the outcome than these variables.

Description of Equipment and Parameters Used

Respond Select
Dual Channel Neuromuscular Electrical Stimulator

reusable, self-adhering, pregelled electrodes

pulse rate - initially set at 1 pulse per second to allow the child to accommodate to stimulation, then increased to 35 pps to achieve tetanic contraction

ramp or rise - set at 4 seconds for greatest comfort

on-off time - initially set for 5/10, for a total time of 20 minutes for comfort and to avoid undue fatigue; increased to 10/15 for 30 minutes as endurance increased

intensity was determined by J.'s indications of discomfort

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